Asian Nursing Research 8 (2014) 261–266

Contents lists available at ScienceDirect

Asian Nursing Research

journal homepage: www.asian-nursingresearch.com

Research Article

Perceptions on Pain Management among Korean Nurses in Neonatal Intensive Care Units

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ARTICLE INFO

Article history:
Received 6 September 2013
Received in revised form
8 April 2014
Accepted 12 May 2014

Keywords:
analgesia
neonates
pain
perception

SUMMARY

Purpose: The present survey was conducted to investigate the perceptions among nurses of neonatal pain and the associated use of pharmacologic measures (PMs) and nonpharmacologic comfort measures (CMs) in neonatal intensive care units (NICUs). Pain perception, the necessity and actual use of PMs and CMs, and their relationships were investigated and compared according to nurses' positions, educational levels, the existence of guidelines, and prior education on neonatal pain management.

Methods: Participants were 141 nurses from five NICUs at university hospitals. A questionnaire was developed by researchers based on previous studies of neonatal pain management and current practices in surveyed NICUs. Five-point Likert scales were used to assess nurses' perceptions of pain, the necessity of PMs and CMs, and their actual use in 29 painful procedures.

Results: The mean scores of perceived pain and the necessity of PMs and CMs were 3.68, 2.96, and 3.79 points, respectively. The actual use of PMs and CMs was 1.67 and 2.63 points, respectively. The perceived necessity of PMs correlated with the actual use of PMs ($r = .316$, $p < .001$), and CMs were performed ($r = .390$, $p < .001$). Keeping or reading guidelines, or receiving education on pain management resulted in a higher perception of the necessity of PMs.

Conclusion: Korean nurses in NICUs often underestimate the necessity of pain relief measures and use few PMs or CMs. Therefore, systematic approaches to implement guidelines, such as adaptation of guidelines for each NICU, dissemination of guideline content to all NICU staff, and regular measurements of compliance with the guidelines, are recommended.

Introduction

The survival rate of premature babies and high-risk newborns has significantly improved due to the rapid development of medical technologies and equipment associated with managing newborns, and the intensive care provided at neonatal intensive care units (NICUs) (Jang, 2010). However, during treatment procedures, high-risk newborns are repeatedly exposed to painful procedures that could induce various levels of pain or discomfort. Recent studies have reported that these delicate subjects are experiencing an average of 12–14 painful procedures during the first 2 weeks of their lives (Carbajal et al., 2008; Simons et al., 2003).

Newborns are more sensitive to pain than are infants, toddlers, and adults; this sensitivity is more pronounced in premature babies (Fitzgerald, Millard, & Macintosh, 1988). Repeated and prolonged exposure to pain in newborns is associated with developmental disabilities, affecting the brain, behavior, and long-term cognitive, social, and emotional functions (Bhutta, Cleves, Casey, Cradock, & Anand, 2002; Buskila et al., 2003). In particular, compared to healthy, full-term babies, the brain is not fully developed in premature babies, likely lowering their threshold for pain and increasing their sensitivity to a given level of pain (Bouza, 2009; Buskila et al.).

Based on these negative consequences of pain in newborns, several societies and professional organizations from western countries have proposed guidelines for assessing, preventing, and

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http://dx.doi.org/10.1016/j.anr.2014.05.008

managing neonatal pain (American Academy of Pediatrics & Canadian Paediatric Society, 2006; Anand, 2001). Such guidelines recommend that printed guidelines or protocols on neonatal pain management be furnished in newborn nurseries or NICUs. Further, they recommend that healthcare professionals be responsible for the assessment, prevention, and management of neonatal pain. The recommended interventions for pain prevention include reducing and preventing unnecessary procedures and selecting measures that induce the least amount of pain (Harrison, Yamada, & Stevens, 2010). When painful procedures are unavoidable, the guidelines recommend nonpharmacologic comfort care measures (CMs), such as providing sweet solutions, wrapping the infants with blankets, and allowing direct skin-to-skin contact with the mother, or pharmacologic measures (PMs), including administering acetaminophen, other analgesics, or local anesthetics (Anand; Harrison et al.).

However, there is a discrepancy between the recommended guidelines by academic societies and actual healthcare practices. A number of studies reported that not all NICUs have pain management guidelines for newborns (Codipietro, Bailo, Nangeroni, Ponzone, & Grazia, 2011; Harrison, Loughnan, & Johnston, 2006; Lago et al., 2005). One study from Japan reported that about 60% of NICUs had no guidelines for pain management (Ozawa & YoKoo, 2013). In other cases, even if they have these guidelines, the healthcare professionals do not strictly follow them (Carbajal et al., 2008; Lago et al.; Stevens et al., 2010). In China, healthcare professionals in NICUs did not provide pain relief interventions at all for procedural pain (Chen et al., 2012). Further, there was an underestimation of the PMs or CMs considered adequate or necessary in each case (Andersen, Greve-Isdahl, & Jylli, 2007).

This underestimation and improper management of pain among healthcare professionals in NICUs may be because these individuals do not have sufficient time to manage neonatal pain, they are not confident of the benefit–risk ratio of PMs, or they are not fully educated about pain management (Bae, 2012; Lago et al., 2005; Oh & Noh, 2009). Furthermore, they may have insufficient skills in neonatal pain assessment or do not know which pain relief interventions are effective in neonates (Kim, Lee, Ham, Kim, & Yi, 2010; Noh & Oh; Oh & Noh, 2009; Shin & Kim, 2003).

Therefore, in this study, we investigated perceptions of neonatal pain, the necessity of PMs and CMs, the use of each measure, and their relationships among Korean nurses in order to identify factors that influence neonatal pain management in Korean NICUs.

Methods

Study design

This was a cross-sectional, descriptive survey study.

Setting and samples

The participants of this study were 141 nurses working in five different NICUs in university-affiliated general hospitals located in three metropolitan centers, Seoul, Daejeon, and Yangsan. A convenience sampling method was used. In order to obtain diverse samples, differences in the level of each NICU, region in which each NICU was located, and the total number of nurses in each NICU were considered. After the selection of NICUs, we tried to include all nurses working at all five NICUs. At the time of this study, of the 147 nurses working in five NICUs, 141 nurses participated in the study, resulting in a response rate of 95.9%.

Ethical considerations

Before the initiation of this study, approval from the hospital's institutional review board was obtained. Participation in the study was voluntary, and any refusal to participate was accepted. Signed consent was obtained, and anonymity and confidentiality were assured to all participants.

Measurements

The self-administered questionnaire consisted of five sections: general characteristics of the participants, utilization of and prior training on pain management guidelines, perception of pain levels, perception of the necessity of PMs or CMs, the use of those measures for 29 painful procedures selected by researchers based on previous studies (Andersen et al., 2007; Carbajal et al., 2008; Simons et al., 2003), and current practices in the study NICUs.

PMs were defined as pharmacologic measures, including administration of intravenous fentanyl, morphine, a topical eutectic mixture of lidocaine and prilocaine, acetaminophen, or other medications. CMs were defined as nonpharmacologic comfort measures, including providing a sweet solution, tucking or swaddling with blankets, nonnutritive sucking, skin-to-skin contact with the mother, or breastfeeding (American Academy of Pediatrics & Canadian Paediatric Society, 2006; Anand, 2001; Harrison et al., 2010; Stevens et al., 2011).

Perception of pain (e.g., How much pain do you think the neonate feels for each procedure?) was measured on a 5-point scale (1 = *no pain* to 5 = *very severe pain*), where higher scores were associated with a greater perception of pain. Internal consistency was measured by Cronbach's alpha as .926.

The perception of the necessity of PMs or CMs (e.g., How necessary do you think PMs or CMs are for reducing pain in neonates for each procedure?) was measured on a 5-point scale (1 = *not necessary to use* to 5 = *must use*), where higher scores presented a higher perception of the necessity of using PMs or CMs. Internal consistency was measured by Cronbach's alpha as .959 for PMs and .966 for CMs.

The actual use of PMs or CMs (e.g., How often do you use PMs or CMs to reduce pain in neonates for each procedure?) was measured on a 5-point scale (1 = *never* to 5 = *always*), where higher scores represented more frequent use of PMs or CMs. Internal consistency was measured by Cronbach's alpha as .906 for PMs .965 for CMs.

Data collection

Data were collected between September 2010 and February 2011. With permission from the nursing department at each hospital, we contacted head nurses of each NICU and directly explained the purpose of this study and how to collect data using the questionnaires. The questionnaires and return envelopes were delivered directly to each head nurse, who distributed the questionnaires to the nurses. The completed questionnaires were sent to the research team in sealed envelopes.

Data analysis

The data were coded and analyzed using SPSS version 18.0 for Windows (SPSS Inc., Chicago, IL). A p value less than .05 was considered statistically significant. General characteristics of the participants were analyzed using means and for continuous variables, and frequencies and percentages for categorical variables. Perception of pain level, the necessity of PMs or CMs, and the use of those measures were analyzed using means and standard deviations. The relationships between pain level perception,

perception of the necessity of PMs or CMs, and the use of those measures were analyzed using Pearson's correlation coefficient. Furthermore, perception of neonatal pain, the necessity of PMs and CMs, and the use of PMs and CMs according to the participants' educational levels, positions, the existence of guidelines, or training on neonatal pain management were analyzed with *t* tests.

Results

General characteristics of participants

All participants were female and averaged 26.7 years of age. The average working years were 4.1 years with 3.2 years in NICUs. In total, 92.2% of the participants responded that their department had neonatal pain management guidelines, 78.7% of them had read the guidelines, and 74.5% of them had received education on pain management. Regarding the type of education, 67.4% of nurses received in-hospital education, while 18.4% of them received out-hospital education, such as continuing education programs on pain provided by academic societies or attending an academic symposium (Table 1).

Pain level perception, perception of necessity of PMs and CMs, and the use of PMs and CMs

The average perceived pain was 3.68 out of 5 points. Scores for the perception of the necessity of PMs and the necessity of CMs were 2.96 and 3.79, respectively. The actual use of pain relief measures with PMs or CMs was 1.67 and 2.63, respectively (Table 2).

Chest tube insertion scored the highest for perception of pain, with 4.70 points and followed by lumbar puncture (4.59) and peritoneal puncture (4.51). Chest tube insertion was the procedure most perceived as requiring PMs and scored 4.16 points, followed by peritoneal puncture (4.00) and peritoneal dialysis (PD) catheter insertion (3.83). Chest tube insertion scored the highest for perceived necessity of CMs, with 4.24 points, followed by peritoneal puncture (4.18) and lumbar puncture (4.17). Chest tube insertion was the procedure most commonly accompanied by PMs, which scored 3.28 points, followed by PD catheter insertion (2.58) and peritoneal puncture (2.57). Venipuncture was the procedure most commonly accompanied by CMs, which scored 3.25 points, followed by intravenous (IV) catheter insertion (3.23) and retinopathy of prematurity exam (3.19) (Table 2).

Table 1 *General Characteristics of Study Participants (N = 141).*

Characteristics		*n*	%
Gender	Female	141	100.0
Age (year)	*M* ± *SD*	26.7 ± 3.8	
Education	3-year college	35	24.8
	4-year college	101	71.6
	Master and above	5	3.5
Position	Staff nurse	128	90.8
	Charge nurse	10	7.1
	Head nurse	3	2.1
Working year at hospital (year)	*M* ± *SD*	4.1 ± 3.9	
Working year at NICU (year)	*M* ± *SD*	3.2 ± 3.2	
Have guideline on neonatal pain management	Yes	130	92.2
	No	4	2.8
	Don't know	7	5.0
Have read guideline on neonatal pain management	Ever	111	78.7
	Never	30	21.3
Have taken education on neonatal pain management	Ever	105	74.5
	Never	36	25.5
Type of education (multiple responses)	In-hospital	95	67.4
	Out-hospital	26	18.4
	Reading articles	16	11.3

Note. NICU = neonatal intensive care unit.

Relationship between perception of pain level, perception of necessity of PMs and CMs, and use of PMs and CMs

Perception of neonatal pain was significantly associated with perception of the necessity of PMs ($r = .426$, $p < .001$) and CMs ($r = .341$, $p < .001$) but were not associated with the actual performance of those treatments. The perception of the necessity of PMs was significantly associated with the performance of PMs ($r = .316$, $p < .001$) and CMs ($r = .235$, $p = .005$). Similarly, the perception of the necessity of CMs was significantly associated with the performance of CMs ($r = .390$, $p < .001$) (Table 3). Interestingly, the perception of the necessity of PMs was significantly associated with the necessity of CMs ($r = .428$, $p < .001$), and the actual use of PMs was associated with the actual use of CMs ($r = .328$, $p < .001$). These findings suggest that PMs are often accompanied by CMs.

Relationship between general characteristics and perception of pain level, perception of necessity of PMs and CMs, and use of PMs and CMs

The perception of the necessity of pain relief measures was related with nurses' higher education about PMs ($t = -2.38$, $p = .019$) and CMs ($t = -2.39$, $p = .018$). The presence of guidelines in NICUs ($t = 3.43$, $p = .001$) or receiving education on pain management ($t = 2.89$, $p = .004$) resulted in a high perception of the necessity of PMs. However, the perception of neonatal pain and the actual use of PMs or CMs were unrelated with education, position, keeping or reading guidelines on neonatal pain management, and receiving education on pain management (Table 4).

Discussion

In this study, the perceived level of pain induced by procedures in NICUs was 3.68; the necessity of PMs for pain relief was 2.96, and the necessity of CMs was 3.79; the actual use of PMs or CMs for painful procedures was 1.67 and 2.63 points, respectively. These findings show that nurses working at NICUs appear to perceive that neonates felt a moderate level of pain during painful procedures. However, pain relief measures were not performed to the same extent in neonates, although they are believed to be necessary.

Regarding perceptions of pain level, 22 of the 29 procedures in our study were considered to cause more than moderate pain (3 points on a 5-point Likert scale), and all 29 procedures caused more than slight pain (2 points on a 5-point Likert scale). Although a direct comparison between the studies is impossible due to differences in painful procedures, these results are similar to previous results (Andersen et al., 2007; Carbajal et al., 2008). Doctors and nurses working in Norwegian NICUs reported that 8 of 10 procedures caused more than a moderate level of pain (Andersen et al.), and healthcare professionals working at 13 American NICUs reported that all procedures caused pain rating greater than 40 out of 100 points (Carbajal et al.). Our participants identified chest tube insertion and lumbar puncture as the most painful procedures, which were similar to the results of previous studies (Andersen et al.).

The actual use of PMs or CMs for painful procedures was very rare in this study. PMs were often used during only chest tube insertion, and CMs were only used during five procedures. This low level of PM or CM use seems to be similar to the results of a previous study (Lago et al., 2005). In one study of 90 NICUs in Italy, PMs or CMs were used for endotracheal suction (14.4%), urinary catheter

Table 2 *Pain Level Perception, Perception of Necessity and Actual Use of PM or CM for Painful Procedures in NICU (N = 141).*[a]

Painful procedures	Pain level perception		Perception about necessity of PM		Perception about necessity of CM		Actual use of PM		Actual use of CM	
	M ± *SD*		*M* ± *SD*		*M* ± *SD*		*M* ± *SD*		*M* ± *SD*	
Endotracheal intubation	4.35 ± 0.69	(4)	3.50 ± 0.83	(8)	3.75 ± 0.91	(17)	1.82 ± 0.81	(9)	2.38 ± 1.06	(21)
Endotracheal extubation	2.78 ± 0.76	(27)	2.40 ± 0.85	(23)	3.39 ± 1.02	(25)	1.38 ± 0.53	(18)	2.10 ± 0.97	(29)
E-tube suctioning	3.51 ± 0.83	(18)	2.44 ± 0.83	(22)	3.58 ± 1.01	(19)	1.33 ± 0.54	(20)	2.12 ± 0.91	(27)
Nasal suctioning	3.77 ± 0.80	(15)	2.35 ± 0.86	(24)	3.55 ± 0.98	(21)	1.26 ± 0.44	(24)	2.15 ± 0.91	(26)
Oral suctioning	3.11 ± 0.86	(21)	2.29 ± 0.82	(25)	3.50 ± 1.02	(23)	1.26 ± 0.44	(24)	2.12 ± 0.91	(27)
Chest physiotherapy	2.64 ± 0.84	(29)	2.20 ± 0.86	(28)	3.38 ± 0.95	(26)	1.26 ± 0.50	(26)	2.30 ± 0.96	(23)
Venipuncture	4.06 ± 0.85	(10)	3.01 ± 1.04	(15)	4.01 ± 0.69	(10)	1.43 ± 0.65	(16)	3.25 ± 1.01	(1)
Arterial puncture	4.34 ± 0.72	(5)	3.13 ± 1.02	(11)	4.04 ± 0.69	(7)	1.43 ± 0.60	(15)	3.01 ± 1.06	(6)
IV catheter insertion	4.01 ± 0.88	(11)	3.15 ± 0.98	(10)	4.06 ± 0.72	(5)	1.50 ± 0.72	(14)	3.23 ± 0.98	(2)
IV catheter removal	2.81 ± 0.89	(26)	2.48 ± 0.88	(20)	3.49 ± 0.98	(24)	1.30 ± 0.49	(23)	2.50 ± 1.03	(18)
Central catheter insertion	4.26 ± 0.87	(7)	3.72 ± 0.94	(5)	4.06 ± 0.72	(5)	2.53 ± 1.05	(4)	2.90 ± 1.06	(8)
Arterial catheter insertion	4.21 ± 0.84	(8)	3.52 ± 0.95	(7)	4.03 ± 0.73	(9)	1.72 ± 0.80	(10)	2.77 ± 1.09	(11)
Umbilical catheter insertion	3.11 ± 1.02	(22)	3.06 ± 0.97	(14)	3.72 ± 0.91	(18)	1.62 ± 0.71	(12)	2.30 ± 1.01	(24)
Intramuscular injection	3.85 ± 0.89	(14)	2.82 ± 1.17	(16)	3.88 ± 0.85	(13)	1.96 ± 1.28	(7)	3.11 ± 1.15	(4)
Subcutaneous injection	3.98 ± 0.89	(13)	2.76 ± 1.12	(17)	3.84 ± 0.84	(15)	1.52 ± 0.87	(13)	2.82 ± 1.11	(10)
Heel stick	3.51 ± 0.87	(19)	2.53 ± 1.02	(19)	3.82 ± 0.87	(16)	1.31 ± 0.60	(22)	2.98 ± 1.02	(7)
Adhesive removal	2.94 ± 0.85	(24)	2.09 ± 0.85	(29)	3.37 ± 1.01	(27)	1.21 ± 0.41	(29)	2.51 ± 1.01	(16)
Wound treatment	3.62 ± 0.93	(17)	3.11 ± 1.04	(12)	3.98 ± 0.85	(12)	1.65 ± 0.77	(11)	3.03 ± 0.90	(5)
Chest tube insertion	4.70 ± 0.53	(1)	4.16 ± 0.81	(1)	4.24 ± 0.74	(1)	3.28 ± 1.19	(1)	2.77 ± 1.17	(12)
Peritoneal puncture	4.51 ± 0.66	(3)	4.00 ± 0.87	(2)	4.18 ± 0.75	(2)	2.57 ± 1.14	(3)	2.64 ± 1.13	(14)
Lumbar puncture	4.59 ± 0.61	(2)	3.72 ± 0.92	(4)	4.17 ± 0.74	(3)	1.85 ± 0.90	(8)	2.86 ± 1.13	(9)
Urinary catheter insertion	3.72 ± 0.78	(16)	3.06 ± 0.93	(13)	3.85 ± 0.75	(14)	1.41 ± 0.63	(17)	2.57 ± 1.00	(15)
Bladder compression	2.87 ± 0.78	(25)	2.45 ± 0.94	(21)	3.50 ± 0.92	(22)	1.31 ± 0.52	(21)	2.27 ± 0.92	(25)
Gastric tube insertion	2.94 ± 0.83	(23)	2.26 ± 0.87	(27)	3.36 ± 1.00	(28)	1.22 ± 0.42	(28)	2.41 ± 1.02	(20)
ROP exam	4.00 ± 0.89	(12)	3.28 ± 1.12	(9)	4.12 ± 0.77	(4)	1.99 ± 1.32	(6)	3.19 ± 1.07	(3)
Nasal cannula insertion	2.67 ± 0.99	(28)	2.28 ± 0.91	(26)	3.30 ± 1.01	(29)	1.23 ± 0.42	(27)	2.35 ± 1.06	(22)
PD catheter insertion	4.20 ± 0.85	(9)	3.83 ± 1.00	(3)	4.04 ± 0.82	(8)	2.58 ± 1.33	(2)	2.51 ± 1.09	(17)
Bladder puncture	4.29 ± 0.77	(6)	3.65 ± 1.01	(6)	4.01 ± 0.86	(11)	1.99 ± 1.02	(5)	2.50 ± 1.07	(19)
NCPAP cannula insertion	3.28 ± 0.90	(20)	2.61 ± 0.91	(18)	3.57 ± 0.94	(20)	1.35 ± 0.55	(19)	2.67 ± 1.14	(13)
Total	3.68 ± 0.47		2.96 ± 0.65		3.79 ± 0.62		1.67 ± 0.42		2.63 ± 0.74	

Note. PM = pharmacologic measures; CM = nonpharmacologic comfort measures; NICU = neonatal intensive care unit; E-tube = endotracheal tube; IV = intravenous; ROP = retinopathy of prematurity; PD = peritoneal dialysis; NCPAP = nasal continuous airway pressure.

[a] Numbers in parentheses denote rank.

insertion (24.4%), heel lance (44.4%), venipuncture (51.1%), lumbar puncture (58.8%), and chest tube insertion (67.7%) (Lago et al.).

Overall, for most procedures, CMs were performed more often than PMs, and cases using PMs alone were rare. However, chest tube insertion and PD catheter insertion were most commonly associated with pre-operative PMs to relieve pain; for these procedures, the use of PMs exceeded that of CMs. These results are similar to those of Carbajal et al. (2008), who surveyed 13 NICUs in France and found that CMs were more frequently performed than were PMs (18.2% vs. 2.1%, respectively). In contrast, our results differ from those of Stevens et al. (2011) who studied eight NICUs in Canada and reported that PMs were performed more often than CMs (44.9% vs. 12.8%, respectively). Although the exact reasons for these differences are unknown, they could be due to differences in methodologies for measuring the pain relief measures. Specifically, the present study assessed the performance of interventions based on the healthcare professionals' subjective evaluations. In contrast, Carbajal et al. prospectively investigated the use of pain relief interventions for painful procedures, and Stevens et al. retrospectively analyzed medical records.

Table 3 *Correlation among Variables (N = 141).*

	Perception on necessity for PM	Perception on necessity for CM	Actual use of PM	Actual use of CM
	r (*p*)	*r* (*p*)	*r* (*p*)	*r* (*p*)
Perception on painfulness	.426 (<.001)	.341 (<.001)	.109 (.197)	.101 (.235)
Perception on necessity for PM		.428 (<.001)	.316 (<.001)	.235 (.005)
Perception on necessity for CM			−.002 (.980)	.390 (<.001)
Actual use of PM				.328 (<.001)

Note. PM = pharmacologic measures; CM = nonpharmacologic comfort measures.

The painful procedures for which PMs were most commonly used were chest tube insertion, PD catheter insertion, and peritoneal puncture. In contrast, procedures for which CMs were most commonly used were intramuscular injection, venipuncture, and peripheral intravenous catheter insertion. Interestingly, most of procedures during which PMs were commonly used were procedures performed by doctors, whereas procedures during which CMs were mainly used were procedures performed by nurses. These findings reflect the current status of neonatal pain management in Korean NICUs. In Korea, nurses, even nurse practitioners, cannot prescribe medication. Therefore, if the nurses perceive neonatal pain, they must ask a doctor to prescribe medication. Similar to our findings, in a French study, PMs were used in procedures performed mostly by doctors, such as endotracheal intubation (41.6%), chest tube insertion (34.8%), central venous catheter insertion (27.5%), and arterial puncture (10.3%), whereas CMs were used in procedures performed by nurses, such as venipuncture (66.6.%), peripheral intravenous catheter insertion (67.5%), and subcutaneous injection (85.5%) (Carbajal et al., 2008).

In the present study, the participants' perception of pain did not correlate to the actual use of PMs and CMs. However, the perception of the necessity of pain relief measures was related to the actual use of PMs and CMs. These findings emphasize the importance of nurses' awareness of the necessity of neonatal pain relief measures to prevent neonatal pain in NICUs. Considering the relatively short working years of Korean NICU nurses, due to both high turnover rate and mandatory rotation policy, it is imperative to provide

Table 4 *Comparison of Pain Level Perception, Perception of Necessity and Actual Use of PM or CM prior to Procedure by General Characteristics (N = 141).*

Characteristics		Pain level perception	Perception about the necessity of		Actual use of	
		M ± *SD*	PM *M* ± *SD*	CM *M* ± *SD*	PM *M* ± *SD*	CM *M* ± *SD*
Education	3-yr college	3.58 ± 0.53	2.74 ± 0.67	3.57 ± 0.58	1.65 ± 0.42	2.49 ± 0.57
	4-yr college & above	3.71 ± 0.45	3.03 ± 0.62	3.86 ± 0.62	1.67 ± 0.42	2.68 ± 0.78
	t	−1.39	−2.38	−2.39	−0.31	−1.33
	p[a]	.167	.019	.018	.760	.184
Position	Staff nurse	3.68 ± 0.45	2.97 ± 0.63	3.79 ± 0.62	1.68 ± 0.43	2.65 ± 0.74
	Charge/head nurse	3.68 ± 0.68	2.86 ± 0.76	3.72 ± 0.66	1.53 ± 0.31	2.47 ± 0.75
	t	0.01	0.57	0.37	1.25	0.80
	p[a]	.996	.572	.709	.214	.423
Have guideline on neonatal pain management	Yes	3.68 ± 0.48	3.01 ± 0.61	3.81 ± 0.61	1.67 ± 0.42	2.63 ± 0.71
	No or Don't know	3.65 ± 0.46	2.34 ± 0.79	3.55 ± 0.76	1.62 ± 0.44	2.62 ± 1.04
	t	0.21	3.43	1.30	0.35	0.04
	p[a]	.837	.001	.195	.729	.972
Have read guideline on neonatal pain management	Ever	3.66 ± 0.48	3.01 ± 0.61	3.79 ± 0.60	1.68 ± 0.43	2.67 ± 0.72
	Never	3.72 ± 0.47	2.80 ± 0.76	3.79 ± 0.71	1.61 ± 0.39	2.49 ± 0.79
	t	−0.61	1.56	0.01	0.89	1.23
	p[a]	.542	.120	.994	.376	.221
Have taken education on neonatal pain management	Ever	3.70 ± 0.47	3.05 ± 0.63	3.82 ± 0.60	1.69 ± 0.42	2.70 ± 0.72
	Never	3.60 ± 0.49	2.70 ± 0.63	3.68 ± 0.69	1.60 ± 0.42	2.44 ± 0.77
	t	1.07	2.89	1.21	1.04	1.86
	p[a]	.286	.004	.230	.301	.065

Note. PM = pharmacologic measures; CM = nonpharmacologic comfort measures.
[a] *p* values were obtained from *t* test.

proper education on neonatal pain management for NICU nurses. In fact, in this study, the perception of the necessity of PMs was related to whether neonatal pain management guidelines were present in the workplace, and whether participants had been educated in neonatal pain management programs. Similar to these findings, in one study, nurses' knowledge of pain intervention methods and experiences of pain education were related to pain management (Noh & Oh, 2011).

The international guidelines for neonatal pain management recommend furnishing each nursing unit with printed guidelines to ensure effective neonatal pain management (Anand, 2001). One study reported that for endotracheal intubation, the number of units always providing pre-operative medication and mechanical ventilation was 12.4-fold and 8.33-fold higher in those with pain management guidelines compared to those without (95%CI [2.8, 53.9] and 95%CI [2.8, 24.4]) (Lago et al., 2005). In our study, 92.2% of nurses responded that their unit has printed guidelines for neonatal pain management, as do 15.0% of institutions in Austria (Harrison et al., 2006), 65.0% in France (Debillon, Bureau, Savagner, Zupan-Simunek, & Carbajal, 2002), 66.6% in Italy (Codipietro et al., 2011), and 88.0% in Sweden (Eriksson & Gradin, 2008). However, 7.8% of the participants answered that they did not have the guidelines or did not know whether the guidelines were furnished in their workplaces. Considering that high-risk newborns in the NICU are exposed to various painful procedures, and prolonged pain can cause developmental disabilities of the brain and behavioral problems (Bhutta et al., 2002; Buskila et al., 2003), every nurse should be aware of pain management guidelines and be able to provide interventional strategies to prevent or reduce neonatal pain. Furthermore, more effort from the unit or hospital to improve pain management should be given.

This study investigated the perception of pain level, the perception of the necessity of pain reduction measures, and the actual use of those measures for 29 painful procedures among NICU nurses in Korea. However, this study has two limitations. First, nurses were recruited from five NICUs in university-affiliated hospitals among the 93 NICUs in Korea as of 2010 (Jang, 2010). Therefore, these results might not be generalizable to all NICUs in Korea. Second, the data were collected in a self-reported manner, and therefore, the actual use of PMs or CMs among nurses working in NICUs could be overestimated.

Conclusion

High-risk newborns hospitalized in NICUs are exposed to various painful procedures. Repeated and prolonged pain is related to developmental disabilities of the brain and behavioral abnormalities. However, this study showed that pain relief measures in neonates were not performed to the same extent, although they are believed to be necessary. Even for procedures perceived to induce severe pain, PMs and CMs were rarely performed except in cases of chest tube insertion and central catheter insertion. Therefore, nurses caring for high-risk newborns should perform PMs or CMs to prevent or reduce neonatal pain. Systematic approaches for implementing practical guidelines, such as adaptation of guidelines for each NICU, dissemination of guideline content to all NICU staff, and regular measurements of compliance with the guidelines, are recommended.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgment

This work was supported by a 2-Year Research Grant of Pusan National University.

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